Operation and System Administration

1. **Overview**
   - Basic Setup
     - The system consists of a sphere surrounded by four projectors
     - Each projector is connected and driven by a display computer
     - Each computer/projector pair is responsible for it's own quadrant of the sphere
     - There is an additional computer to control them all
   - Computer Projector Pairs
     - The projectors are numbered 1 – 4 and each computer is named for the projector that it controls
     - Each display computer pulls in content, renders it to a Earth projection, and displays the image on the sphere on command
   - Network Controller
     - The fifth computer is the network controller (nc) for the SOS computing cluster
     - The nc computer is responsible for:
       - Running the main user interface for the system
       - Synchronization of the display nodes
       - NFS file sharing for content
       - Real time data collection
       - Router/gateway to the SOS system
       - Interface to the automation control protocol
   - Computer Details
     - All of the computers are Linux based (currently Redhat 4 or Redhat 5)
     - Most sites buy a "hot" spare that is used in the case of a single computer failure
     - All of the software that drives and controls the SOS system is written and maintained by NOAA

2. **System Specifications**
   - Each node is a standard computer with mid to high-end graphics hardware and two Ethernet cards
   - The nodes are generally identical from a hardware perspective to allow for easy swapping of the components
   - The projectors are classified as "board room" projectors, which can be left on for extended periods of time
   - They are also specified to produce a high light output (Lumens), typically 3500 to 5000 Lumens

3. **Science On a Sphere Network**
   - Network
     - The computers are connected via a gigabit network to enable high speed communication and data transport

- The SOS cluster mostly resides in a private, non-routable network space (usually in the 10.x.x.x range)
- The display nodes are isolated from the network because of their special purpose
- By isolating the cluster, the network can be very open and easily communicate between computers without the traffic affecting the sites network

➢ nc on the Network
- nc is the only computer that uses both Ethernet cards, one for the private SOS network and the other for the sites intranet
- nc usually sits on the border between the private SOS network and the local intranet
- This allows for access to real-time data, remote systems administration, and software updates

➢ Firewalls for SOS
- nc runs a kernel based firewall package to protect against undesirable traffic
- nc acts like a router for the private SOS network
- Firewall filters on nc are designed to drop every incoming connection except for secure shell access

4. File Serving

➢ Role of nc
- nc serves at the Network File System (NFS) for the SOS cluster
- The display nodes rely on nc to provide access to the SOS display software and data
- All of the data on nc is accessible by the display nodes through the /shared/sos/media directory on nc
- Local copies of the data are stored in the /sos/media directory on the display nodes (this is merely an archive)

5. Backups

➢ The local copies of the data on the display nodes in the /sos/media directories serve as a backup for all of the displayable data

➢ All of the displayable data and the SOS software is also retrievable from NOAA

➢ Custom datasets developed by the site should be archived by the site

➢ The custom playlists and the alignment configuration files are automatically archived each night and synced to each node to create a backup

6. System Maintenance

➢ Power Down Schedule
- It is recommended that the entire SOS cluster remain powered up all of the time if the site is receiving real time data
- Projectors only need to be on during operation

- Turning the projectors off when not in use will save lamp life
- If the system must be powered down, close the SOS software, turn off each display node, and turn off nc last

➢ Turning the System
- When turning the system on, make sure to fully boot nc before turning on the display nodes

➢ Projector Maintenance
- Projector alignment should be checked daily to maximize the sphere's appearance
- A typical projector lamp lasts 1500 to 3000 hours
- As lamps age, they will start to dim or show discolor and then, in most cases, suddenly go out
- When one lamp is replaced, all of the lamps should be replaced to make the sphere image look uniform
- Projector filters should be checked monthly (in dusty sites, this should be more often) to ensure proper airflow
- Dirty filters reduce the cooling capacity and shorten the projector lamp life

➢ Computer Maintenance
- The computers are typically maintenance free
- Once your Redhat software is licensed, you have access to Redhat updates and patches
- The patches, especially those dealing with security issues, should be applied as they are released
- We will inform sites if any patches break the SOS software

7. User Accounts

➢ In Linux, every process that is run must have a user id
➢ There are three main user id's for the SOS system
➢ User id: sosdemo
- Unprivileged user that can start the SOS software, create playlists and give presentations
- Can not delete any data or any software
- Can only delete playlists that they have created

➢ User id: sos
- Has the right to add or delete data, playlists, and some software
- Use this id when adding new datasets to the system
- Have to be logged in as SOS when aligning the sphere or applying software upgrades

➢ User id: sosrt
- Background user account used to manage and transfer real time data feeds

➢ The super user in Linux (like the administrator in Windows) is root
- It is recommended to not use root directly, but rather use the "sudo" command which temporarily raises a normal users privilege to root for the duration of a single command (sosdemo can't use sudo)
- root has unrestricted privileges and therefore can do the most damage